p.183

More explicitly, a $\boxed{}$

can be perfectly reconstructed.

To formalize this idea, we consider a new type of sampling:

Remark 1: $x[n]$ and $x_p(t)$ present the same amount of info. ⇒ They are equivalent.

Remark 2:

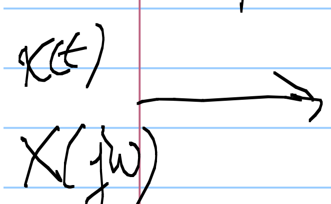
P.184

Remark 3: ITS is a conceptual tool, not implementable in practice.

But as we will see, $x_p(t)$ (ITS) is more convenient for analysis

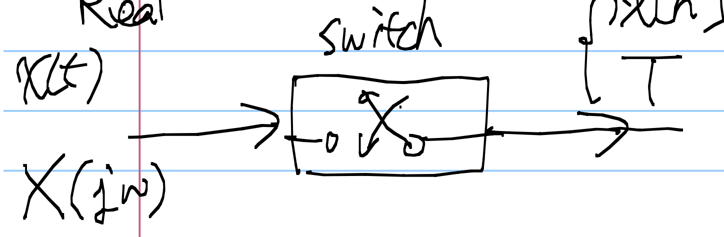
* Let us focus more on ITS. Conceptually, how do we perform ITS?

Conceptual:



$\boxed{\text{Let us focus on the freq domain of the systems}}$

Real

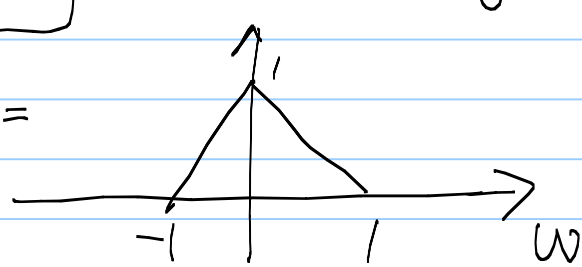


Q: What is the CTFT of $x_p(t)$?

Ans:

In sum, the freq spectrum $X_p(j\omega)$ of $x_p(t)$ is the periodically shifted version of $X(j\omega)$ with period $\boxed{}$ & a scaling factor $\boxed{}$

Example: $X(j\omega) =$



Consider a sampling freq 2 Hz, what

is the $X_p(j\omega)$, the CTFT of its ITS $x_p(t)$.

Ans:

Q: Conceptually, how to recover $x(t)$ from $x_p(t)$?

Ans

* Side note: Compare it with AM

AM ITS

(cont'd)
To ensure perfect reconstruction, we need
AM ITS

Otherwise we will have freq overlap.

★ Sampling theorem

Let $x(t)$ be a band-limited signal s.t. $|X(j\omega)| = 0$ if $|\omega| > W_M$

Then $x(t)$ can be perfectly reconstructed from its samples provided the sampling freq ω_s satisfies

If ω_s is large (sampling fast enough when compared to the underlying signal.) we can reconstruct the original signal.